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(71)Applicant : RICOH CO LTD

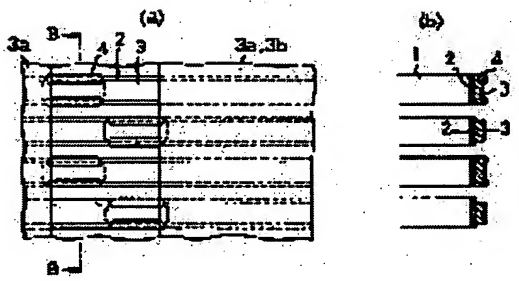
(72)Inventor : NAKANO TOMOAKI

## (54) INK JET HEAD, MANUFACTURE THEREOF AND CONDUCTOR PATTERN USED FOR THE MANUFACTURE

(57)Abstract:

PURPOSE: To eliminate a short-circuit due to extension of solder when a plurality of electrode members of a piezoelectric element is batch connected to a conductor pattern.

CONSTITUTION: External electrodes 2 of a piezoelectric element 1 divided at a predetermined pitch are arranged, and a conductor pattern 3 corresponding to the electrodes 2 are solder-connected to the electrodes 2. In this case, even if solder 4 is extended, adjacent solder connecting surfaces are so deviated that extended solders of the adjacent electrodes are not brought into contact with one another.

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CLAIMS

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[Claim(s)]
[Claim 1] A substrate Two or more ink passage in which ink liquid is held A nozzle opened for free passage by each ink passage An actuator which consists of two or more laminating piezoelectric devices which it is prepared [ piezoelectric devices ] corresponding to each of said ink passage, and make ink liquid breathe out from said nozzle an ink jet arm head equipped with the above -- it is -- a conductor of said piezoelectric device or an electrode member of a substrate, and said attachment component -- it is characterized by making a cementation field with a pattern differ mutually between contiguity cementation fields.
[Claim 2] a conductor of said cementation field -- width of face of a pattern -- a conductor of other portions -- an ink jet arm head according to claim 1 characterized by making it larger than width of face of a pattern.
[Claim 3] A substrate Two or more ink passage with which ink liquid is held, a nozzle opened for free passage by each ink passage, and an actuator which consists of two or more laminating piezoelectric devices which it is prepared [ piezoelectric devices ] corresponding to each of said ink passage, and make ink liquid breathe out from said nozzle a substrate with which it connected with an actuator which consists of a laminating piezoelectric device in which it is the manufacture method of an ink jet arm head equipped with the above, and an electrode member was prepared, and which is not divided or said actuator, and an electric target, and an electrode member has been arranged, and a conductor currently held by attachment component -- a pattern joins electrically with solder and it is characterized by to perform recessing for subsequently making a joint into independent electrical installation.
[Claim 4] said conductor -- a conductor used for a manufacture method of an ink jet arm head according to claim 3 characterized by having formed independently in the same pitch as a pitch of recessing a location which does not separate a location where a pattern laps with a piezoelectric device or an electrode member of a substrate, and does not lap with an electrode member -- a pattern.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] the conductor which uses this invention for an ink jet arm head, its manufacture method, and its manufacture method -- it is related with a pattern. the conductor used for the ink jet arm head, its so-called manufacture method, and its so-called manufacture method of the multi-nozzle type which has many ink jet nozzles in details more -- it is related with a pattern.
[0002]
[Description of the Prior Art] Drawing 4 is the cross-section block diagram of the conventional ink jet arm head, drawing 4 (a) is drawing of longitudinal section (A-A line cross section of drawing 4 (b)), and drawing 4 (b) is the B-B line view expanded sectional view of drawing 4 (a). In 11, a substrate and 12 among drawing a passage board and 13a for a piezoelectric device and 13 Ink passage, In 13b, a wall and 14 a common liquid room and 15 for a common liquid room configuration member and 14a An ink delivery pipe, 16 a nozzle and 17 for a nozzle plate and 16a The printed circuit board for actuation circuits (PCB), As for a flow-resistance member, and 23 and 24, for the slot where lead wire and 19 divide an actuation electrode and, as for 20, 18 divides a piezoelectric device 12, and 21, a guard plate and 22 are [ an internal electrode (the hot electrode 23, grand electrode 24) and 25 ] up curtain boards.
[0003] Drawing 5 is the important section enlarged view showing the conventional connection (wirebonding) of the actuation electrode 19 of drawing 4 , and PCB (printed circuit board)17, 19a is [ the both-ends electrode of a piezoelectric device and 19c of the electrode on piezoelectric-device 12a and 19b ] common electrodes (gland) among drawing, and connection of the electrodes 19a, 19b, and 19c of each piezoelectric device is carried out to the electrode on PCB17 corresponding to each with the thin lead wire 18 like a graphic display.
[0004] However, according to the above-mentioned conventional technology, since the current which it is necessary to gold-plate at a head lateral electrode and a PCB electrode, and costs start, and flows to a common electrode (grand electrode) serves as the sum total of current which flows to the electrode (hot electrode) of each piezoelectric device, it needs to enlarge current capacity. Therefore, wirebonding must be performed several times, or soldering etc. must be performed at another process, time amount and costs start, and it becomes a cost rise.
[0005] Drawing 6 is drawing showing the example of cementation of the electrode of a piezoelectric device, and the electrode of a signal line shown in JP,55-86765,A. The up electrode with which 30 were arranged in one piezoelectric-device 31 side, and 31 are a piezoelectric device and the lower electrode with which a common electrode and 35 were arranged by the head main part, and 36 was arranged [ 32 / the soldering section and 33 ] in the another side side of a piezoelectric device 31 for a selection electrode and 34 among drawing. It is made to join to the electrode of the diaphragm which formed electrodes 30 and 36 up and down, connected the up electrode 30 with the selection electrode 33 with soldering, and arranged the lower electrode 36 on the pressure room of a piezoelectric device 31 like a graphic display.
[0006] However, by the method of above-mentioned JP,55-86765,A, when integration of an orifice

progresses by improvement in image quality etc. and a piezoelectric device is increased, arrangement of the selection electrode 33 arranged on the head main part 35 becomes complicated, a process takes time amount, an inter-electrode distance also becomes brief, and a possibility of short-circuiting also comes out.

[0007] In order to solve the above-mentioned problem, these people proposed about the ink jet recording device which was made to perform electrical installation of each piezoelectric device and an outer conductor by carrying out pattern separation of the electrode pattern prepared on the substrate previously at slit processing and coincidence of each piezoelectric device (JP,3-73347,A).

[0008] Dip drawing for drawing 7 and drawing 8 to explain an example (JP,3-73347,A) of the ink jet recording head which these people proposed previously, and drawing 9 With the A-A line cross section of drawing 8 , a substrate 40 usually consists of silicon, a ceramic, glass, resin, etc. an electrode Usually, it consists of electrode 41a for connection with the electrode of the piezoelectric-device actuation IC, electrode 41b for connection with external lead wire, and electrode 41for grand electrodes c, and on the substrate 40, patterning of these electrodes is carried out and they are carried out <DP.N=0003> ****. Thus, an electrode joins a piezoelectric device 42 with means, such as adhesion, by positioning of an outline on the substrate 40 by which patterning was carried out ( drawing 7 ). Next, a slit 43 is processed into this piezoelectric device 42 by cutting etc. ( drawing 8 ). Eight [ // about ] integration of mm is attained by processing the width of 30-40 micrometers and a piezoelectric device 42 for the width of a slit 43 by about 80-90 micrometers. This is processible enough with the usual dicing saw etc.

[0009] Drawing 9 is drawing after forming a slit 43 like ****, and an electrode pattern also dissociates and becomes independent of a piezoelectric device 42 being substantially separated by this slit processing at coincidence. That is, a substrate 40 will also be processed in part simultaneously with a piezoelectric device 42 at this time. Moreover, the front face (the M section of drawing 9 ) of a substrate 40 is made not to process it in order to make it not separate grand electrode 41c. At next, it is ****** ( drawing 8 ) by a chip flow etc. about actuation IC 44 (the electrode is arranged according to the pitch of the pattern of the separated electrode). By choosing the construction material of a substrate 40 suitably, it also becomes possible to fully radiate heat in actuation IC 44.

[0010] However, when it carries Actuation IC and a piezoelectric device on the same substrate, it is effective, and as said conventional technology described, wirebonding etc. is needed [ connection is needed for this actuation IC, and ] according to the ink jet arm head which these above-mentioned people proposed previously, when Actuation IC is outside.

[0011] A pattern and 3a of up supporter material and 3b are [ lower supporter material and 4 ] solder. a cross section for drawing 10 to explain the example of the conventional technology of further others -- it is -- the inside of drawing, and 1 -- a piezoelectric device and 2 -- an external electrode and 3 -- a conductor -- this solder 4 -- a conductor -- one field of a pattern 3 -- beforehand -- uniform -- **** -- a **** cage and this conductor -- they are superposition, a pressure welding, and the thing that heats and carries out package cementation about the solder on a pattern at the hot electrode of each piezoelectric device. In addition, the plan of drawing 10 after cementation (a) is shown in drawing 10 (b) at the B-B line cross section of drawing 10 after cementation (a), and drawing 10 (c).

[0012]

[Problem(s) to be Solved by the Invention] the conventional technology given in drawing 10 -- a conductor -- in the case of optimum dose, ******** solder plating in **** to a pattern 3 or the external electrode 2 at homogeneity the case uneven [ elapse or ] where there are many amounts of plating although it does not short-circuit by the flash of solder between contiguity cementation (inter-electrode) -- a conductor -- when a pattern 3 is joined to the external electrode 2, solder overflows crosswise and there is a possibility of short-circuiting between contiguity cementation (inter-electrode). It aims at offering the ink jet arm head which contributes to improvement in reliability while this invention was made in view of the actual condition like ****, raises processability and assembly nature in the electrical installation from an electric actuator means by which high density integrated especially to the exterior and aims at reduction of cost.

[0013]

[Means for Solving the Problem] Two or more ink passage in which (1) substrate and ink liquid are held in order that this invention may solve the above-mentioned technical problem, It is prepared corresponding to a nozzle opened for free passage by each ink passage and each of said ink passage. It is the ink jet arm head which has an actuator which consists of said nozzle from two or more laminating piezoelectric devices which make ink liquid breathe out. Said actuator with which an electrode member has been arranged at said laminating piezoelectric device, In an ink jet arm head which a pattern has joined electrically with solder or a conductor currently held by attachment component at said substrate with which it connected with said actuator and electric target, and an electrode member has been arranged -- a conductor of said piezoelectric device or an electrode member of a substrate, and said attachment component -- having made a cementation field with a pattern differ mutually between contiguity cementation fields -- further (2) -- a conductor of said cementation field -- width of face of a pattern -- a conductor of other portions -- having made it larger than width of face of a pattern -- further (3) A substrate, two or more ink passage in which ink liquid is held, and a nozzle opened for free passage by each ink passage, In a manufacture method of an ink jet arm head of having an actuator which consists of two or more laminating piezoelectric devices which it is prepared [ piezoelectric devices ] corresponding to each of said ink passage, and make ink liquid breathing out from said nozzle An actuator which consists of a laminating piezoelectric device in which an electrode member was prepared, and which is not divided, A pattern is electrically joined with solder. or a substrate with which it connected with said actuator and electric target, and an electrode member has been arranged and a conductor currently held by attachment component -- subsequently performing recessing for making a joint into independent electrical installation -- further (4) -- said conductor -- a location where a pattern laps with a piezoelectric device or an electrode member of a substrate is not separated, but a location which does not lap with an electrode member is characterized by having formed in the same pitch as a pitch of recessing independently.

[0014]

[Function] the electrode member of the piezoelectric device arranged by the predetermined pitch, and the conductor corresponding to this pitch -- in case a pattern is joined with solder, the short circuit by the solder flash between patterns is lost by changing a soldered joint side between contiguity patterns.

[0015]

[Example] Drawing 1 is drawing for explaining one example of this invention. Drawing 1 (a) The plan and drawing 1 (b) equivalent to drawing 10 (c) the B-B cross section of drawing 1 (a) -- the inside of drawing, and 1 -- each actuator of a piezoelectric device, and 2 -- an external electrode (electrode member) and 3 -- a conductor -- in a pattern and 3a, a discharge ring (attachment component) and 4 are solder, a majority of each actuators of a piezoelectric device are formed in one, and an arm top cover (attachment component) and 3b constitute the actuator. This example is the advanced type of the conventional technology shown in drawing 10 , and as it was shown in drawing 10 , when it joins to it, it shifts mutually an adjoining soldered joint side (contiguity cementation field) so that the solder protruded from the electrode in which solder 4 carries out flash contiguity may not be contacted. Thus, even if there is a flash of the solder after cementation by shifting a soldered joint side, the short circuit by the flash of the solder between contiguity patterns is lost, and the reliability of an ink jet arm head goes up.

[0016] the conductor of an example in which drawing 2 is drawing for explaining other examples, the plan with which drawing 2 (a) is equivalent to drawing 10 (c), and drawing 2 (b) are the B-B cross sections of drawing 2 (a), and this example was shown by drawing 1 -- to drawing 2 (a), the large width of face of the joint of a pattern 3 is taken, as dashed line 4a shows. Since the plane-of-composition product is larger than the example shown by drawing 1 in the case of this example, bonding strength becomes good.

[0017] Drawing 3 is drawing for explaining the example of further others of this invention, the cross section with which drawing 3 (a) is equivalent to drawing 10 (a), and drawing 3 (b) are drawings equivalent to the B-B cross section of drawing 3 (a), and 2' is an internal electrode and solder to which 4' has joined internal electrode 2' and the external electrode 2 among drawing. the piezoelectric device 1

and conductor with which this example is not divided yet -- since a pattern 3 is joined by solder -- a piezoelectric device 1 -- a conductor -- recessing is carried out to coincidence the whole pattern 2 (to the S section in drawing 3 (b), and the d section in drawing 3 (a)). the time of performing this recessing -- arm-top-cover 3a and a conductor -- a pattern 3 and the conductor of FPC(flexible print cable)3' which consists of discharge-ring 3b -- if the pattern 3 is already divided into the predetermined pitch, the electrode 2 of the piezoelectric device 1 divided independently, respectively can be taken out by carrying out recessing according to that pitch. moreover, it is shown in drawing 3 (b) -- as -- a conductor, if the pattern 3 is used as the solid pattern (cross hatching shows in the condition that pattern fragmentation is not carried out but the portion joined to a piezoelectric device has tabular [ of one sheet ], and drawing 3 (b)) the time of recessing -- a conductor -- since there is also no fear of damaging a pattern, and the solid pattern of an one-sheet side is joined, it was made to carry out recessing after that and all plane-of-composition products can be used for cementation, it is also raising the reinforcement of a joint.

[0018] In addition, in the example shown in drawing 1 - drawing 3 , although solder plating is used, even if it does not restrict this invention to this and an anisotropy electric conduction film, electroconductive glue, etc. are used for it, it is fitted similarly. Moreover, although the example at the time of applying this invention to cementation of a piezoelectric device and FPC was explained above, this invention can be similarly performed by what is limited to the above-mentioned example, for example, when picking out an electrode from substrates, such as PCB.

[0019]

[Effect of the Invention] The effect corresponding to claim 1: Since solder plating fields differ between contiguity patterns, even if solder overflows at the time of cementation, the short circuit between contiguity stops being able to occur easily, the densification of a piezoelectric device can be possible and, moreover, the reliability of an ink jet arm head can be raised.

the effect:solder plating field corresponding to claim 2 -- a conductor -- since pattern width of face is wide, even if a pattern pitch is narrow, strong bonding strength is obtained, and the reliability of an ink jet arm head goes up.

the effect:piezoelectric device and conductor corresponding to claim 3 -- since recessing is carried out after cementation (heating, application-of-pressure process) to a pattern, an electrode is gained separate independence, there is also no fear of a sheet arising between contiguity patterns since it is certainly divided between contiguity patterns (electrode) and recessing of the pitch between patterns can be carried out to homogeneity, the processability of an ink jet arm head, assembly nature, and reliability go up.

effect: corresponding to claim 4 -- a conductor -- the conductor which is equivalent to the joint of a pattern -- since the pattern section is joined to a piezoelectric device with an one-sheet side (it has not divided), bonding strength becomes stronger and the assembly nature of an ink jet arm head and reliability go up.

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## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the plan and cross section for explaining one example of this invention.
[Drawing 2] It is the plan and cross section for explaining other examples of this invention.
[Drawing 3] It is the cross section and plan for explaining the example of further others of this invention.
[Drawing 4] the cross section of the conventional ink jet arm head -- and it is an expanded sectional view a part.
[Drawing 5] It is the important section enlarged view showing the connection of the piezoelectric device of the conventional ink jet arm head.
[Drawing 6] It is a plan explaining other examples of the conventional ink jet arm head.
[Drawing 7] It is the perspective diagram showing a part of manufacturing process of the conventional ink jet arm head.
[Drawing 8] It is the perspective diagram showing a part of after [ the process shown in drawing 7 ] process.
[Drawing 9] It is the cross section (A-A line cross section of drawing 8 ) of the ink jet recording head shown in drawing 7 and drawing 8 .
[Drawing 10] It is drawing showing other examples which show the connection of the piezoelectric device of the conventional ink jet arm head.
[Description of Notations]
1 -- substrate, a 2 -- external electrode, and 3 -- a conductor -- a pattern, 3a, and a 3b-- attachment component -- 4 [ -- A passage board 13a / -- Ink passage, ] -- Solder, 11 -- A substrate, 12 -- A piezoelectric device, 13 13b [ -- Ink delivery pipe, ] -- A wall, 14 -- A common liquid room configuration member, 14a -- A common liquid room, 15 16 [ -- Lead wire, ] -- A nozzle plate, 16a -- A nozzle, 17 -- FPC, 18 19 [ -- Common electrode, ] -- The actuation polar zone, 19a -- An actuation electrode, 19b -- A both-ends electrode, 19c 20 [ -- A hot electrode, 24 / -- Grand electrode, ] -- A slot, 21 -- A guard plate, 22 -- A flow resistance, 23 25 [ -- Soldering, 33 / -- A dot electrode, 34 / -- A common electrode, 35 / -- A main part, 36 / -- A lower electrode, 40 / -- A substrate, 41a-41c / -- An electrode, 42 / -- A piezoelectric device, 43 / -- A slit, 44 / -- Actuation IC. ] -- An up septum, 30 -- An up electrode, 31 -- A piezoelectric device, 32

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DRAWINGS

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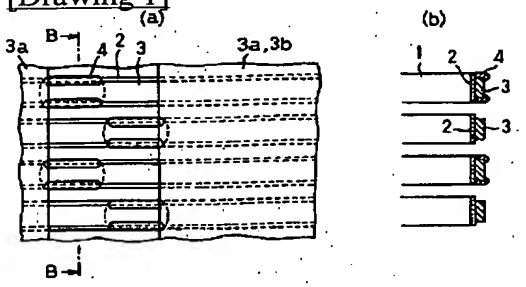
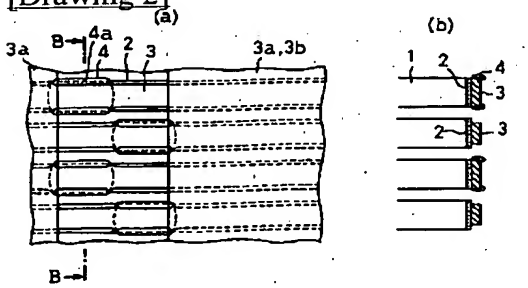
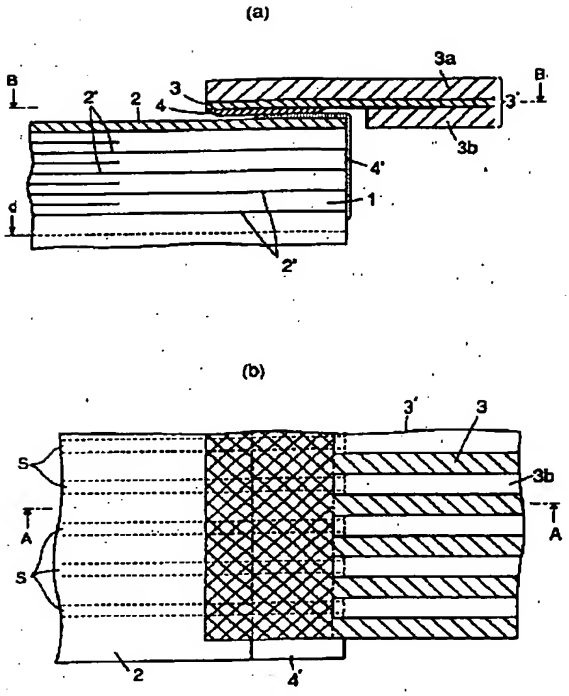
[Drawing 1]



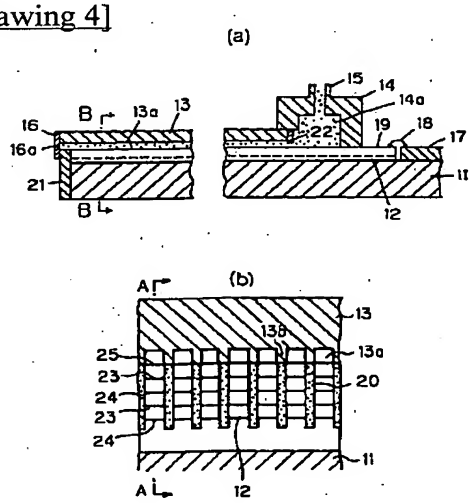

[Drawing 2]



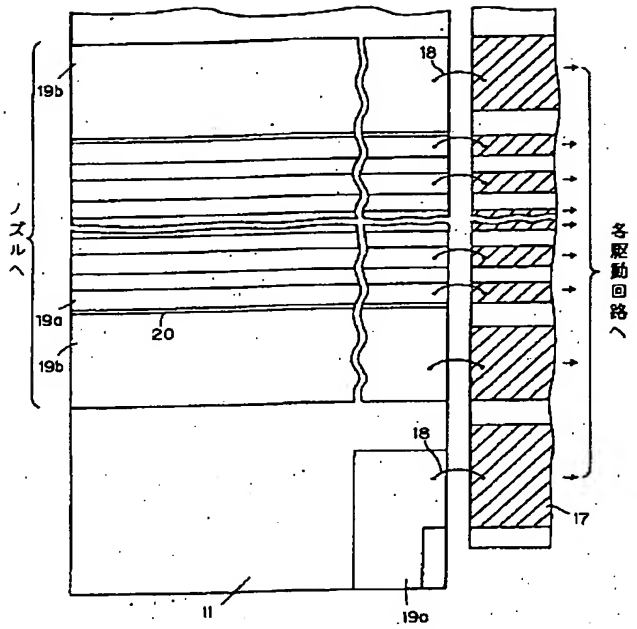

[Drawing 3]



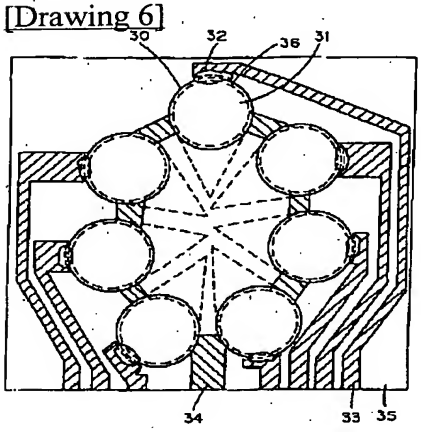

[Drawing 4]



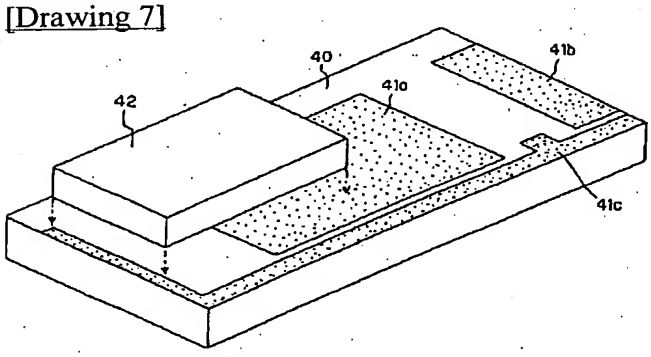

[Drawing 5]



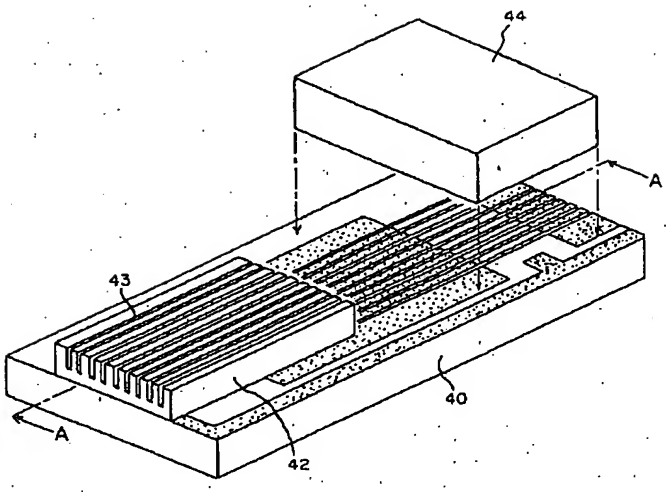

[Drawing 6]




[Drawing 7]




[Drawing 8]

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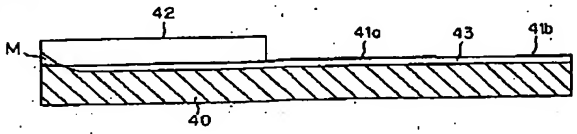
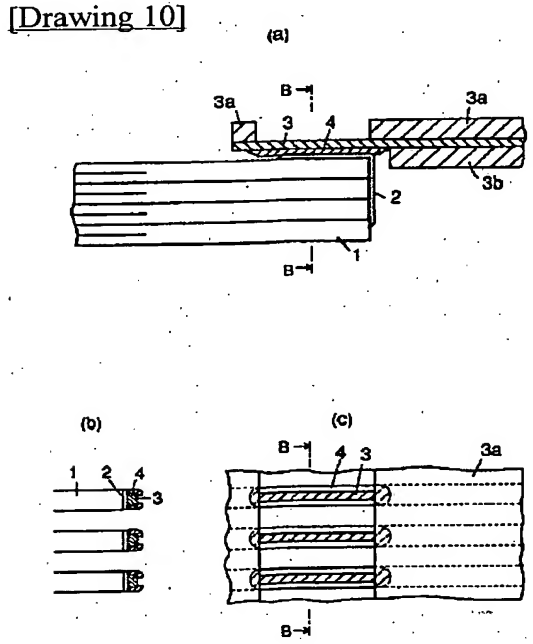



[Drawing 10]

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| Ｂ４１Ｊ　2/01 | | | | |
| 2/045 | | | | |
| 2/055 | | | | |
| | | | Ｂ４１Ｊ　3/04　１０１　Ｚ | |
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審査請求　未請求　請求項の数４　ＯＬ　（全６頁）　最終頁に続く

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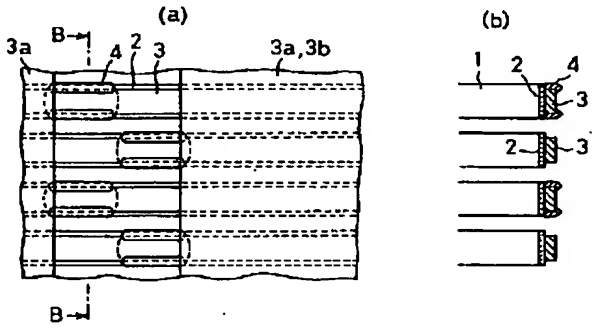
(71)出願人　000006747
株式会社リコー
東京都大田区中馬込１丁目３番６号
(72)発明者　中野　智昭
東京都大田区中馬込１丁目３番６号　株式会社リコー内
(74)代理人　弁理士　高野　明近

(54)【発明の名称】　インクジェットヘッド及びその製造方法及びその製造方法に使用する導体パタン

(57)【要約】

【目的】　圧電素子の複数の電極部材と導体パタンとの接合を一括接合するときに、半田がはみ出してショートしないようする。

【構成】　所定ピッチに分断されている圧電素子１の各々に外部電極２が配列され、この外部電極２に該外部電極２に対応した導体パタン３を半田接合する。その際、半田４がはみ出しても、隣接する電極からの半田のはみ出し同志がと接触しないように、隣接する半田接合面を互いにずらしておく。



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【特許請求の範囲】

【請求項１】　基板と、インク液を収容する複数のインク流路と、各インク流路に連通されたノズルと、前記インク流路の各々に対応して設けられ、前記ノズルよりインク液を吐出させる複数の積層圧電素子より成るアクチュエータとを有するインクジェットヘッドであって、前記積層圧電素子に電極部材が配置された前記アクチュエータ、または、前記アクチュエータと電気的に接続され、電極部材が配置された前記基板に、保持部材によって保持されている導体パタンが、半田により電気的に接合しているインクジェットヘッドにおいて、前記圧電素子または基板の電極部材と前記保持部材の導体パタンとの接合領域を、隣接接合領域間で互いに異なるようにしたことを特徴とするインクジェットヘッド。

【請求項２】　前記接合領域の導体パタンの幅を、他の部分の導体パタンの幅よりも広くしたことを特徴とする請求項１に記載のインクジェットヘッド。

【請求項３】　基板と、インク液を収容する複数のインク流路と、各インク流路に連通されたノズルと、前記インク流路の各々に対応して設けられ、前記ノズルよりインク液を吐出させる複数の積層圧電素子より成るアクチュエータとを有するインクジェットヘッドの製造方法において、電極部材が設けられた分割されていない積層圧電素子から成るアクチュエータ、または、前記アクチュエータと電気的に接続され、電極部材が配置された基板と、保持部材によって保持されている導体パタンとを半田により電気的に接合し、次いで、接合部を独立した電気的接続にするための溝加工を行うことを特徴とするインクジェットヘッドの製造方法。

【請求項４】　前記導体パタンは、圧電素子または基板の電極部材と重なる位置は分離せず、電極部材と重ならない位置は溝加工のピッチと同一のピッチに独立して形成してあることを特徴とする請求項３に記載のインクジェットヘッドの製造方法に使用する導体パタン。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、インクジェットヘッド及びその製造方法及びその製造方法に使用する導体パタンに関する。より詳細には、多数のインクジェットノズルを有する、いわゆるマルチノズル式のインクジェットヘッド及びその製造方法及びその製造方法に使用する導体パタンに関する。

【０００２】

【従来の技術】図４は、従来のインクジェットヘッドの断面構成図で、図４（ａ）は縦断面図（図４（ｂ）のＡ－Ａ線断面図）、図４（ｂ）は図４（ａ）のＢ－Ｂ線矢視拡大断面図で、図中、１１は基板、１２は圧電素子、１３は流路板、１３ａはインク流路、１３ｂは壁部、１４は共通液室構成部材、１４ａは共通液室、１５はインク供給パイプ、１６はノズルプレート、１６ａはノズル、１７は駆動回路用プリント板（ＰＣＢ）、１８はリード線、１９は駆動電極、２０は圧電素子１２を区切る溝、２１は保護板、２２は流体抵抗部材、２３，２４は内部電極（ホット電極２３，グランド電極２４）、２５は上部隔壁板である。

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【０００３】図５は、図４の駆動電極１９とＰＣＢ（プリント基板）１７との従来の結線（ワイヤボンディング）を示す要部拡大図で、図中、１９ａは圧電素子１２ａ上の電極、１９ｂは圧電素子の両端部電極、１９ｃは共通電極（グランド）で、図示のように、各圧電素子の電極１９ａ，１９ｂ，１９ｃは、細いリード線１８で各々に対応するＰＣＢ１７上の電極に結線されている。

【０００４】しかし、上記従来技術によると、ヘッド側電極及びＰＣＢ電極に金メッキを施す必要があり、費用がかかり、また、共通電極（グランド電極）に流れる電流は、各々の圧電素子の電極（ホット電極）に流れる電流の合計となるため、電流容量を大きくする必要がある。したがって、ワイヤボンディングを数回行うか別工程でハンダ付け等を行わなければならず、時間と費用がかかり、コストアップとなる。

【０００５】図６は、特開平５５－８６７６５号公報に示されている圧電素子の電極と信号線の電極の接合例を示す図で、図中、３０は圧電素子３１の一方の側に配設された上部電極、３１は圧電素子、３２はハンダ付け部、３３は選択電極、３４は共通電極、３５はヘッド本体、３６は圧電素子３１の他方の側に配設された下部電極で、図示のように、圧電素子３１の上下に電極３０，３６を設け、上部電極３０をハンダ付けにて選択電極３３と接続し、下部電極３６を圧力室上に配設した振動板の電極に接合するようにしたものである。

【０００６】しかし、上記特開平５５－８６７６５号公報の方法では、画像品質の向上等でオリフィスの集積化が進み、圧電素子が増加された場合、ヘッド本体３５上に配設される選択電極３３の配置が複雑になり工程に時間がかかり、電極間の距離も短かくなり、ショートする恐れもでてくる。

【０００７】上記問題を解決するために、本出願人は、先に、基板上に設けられた電極パタンを各圧電素子のスリット加工と同時にパタン分離することによって、各圧電素子と外部導体との電気的接続を行うようにしたインクジェット記録装置について提案した（特開平３－７３３４７号公報）。

【０００８】図７及び図８は、本出願人が先に提案したインクジェット記録ヘッドの一例（特開平３－７３３４７号公報）を説明するための傾斜図、図９は、図８のＡ－Ａ線断面図で、基板４０は通常シリコン、セラミック、ガラス、樹脂等よりなり、電極は、通常、圧電素子駆動ＩＣの電極との接続用電極４１ａと、外部リード線との接続用電極４１ｂと、グランド電極用電極４１ｃとから成り、これら電極が基板４０上にパターニングされ

て施されている。このように、電極がパターニングされた基板４０上に、概略の位置決めによって圧電素子４２を、たとえば、接着等の手段により接合する（図７）。つぎにこの圧電素子４２にスリット４３の加工を、たとえば、切削加工等により行う（図８）。スリット４３の巾を３０～４０μｍ、圧電素子４２の巾を８０～９０μｍ程度で加工することにより８本／ｍｍ程度の集積化が可能となる。これは通常のダイシングソー等により十分加工可能である。

【０００９】図９は、上述のごとく、スリット４３を形成した後の図で、このスリット加工によって圧電素子４２が実質的に分離されるのと同時に電極パタンも分離・独立される。つまり、このとき圧電素子４２と同時に基板４０も一部加工することになる。また、基板４０の前面（図９のＭ部）は、グランド電極４１ｃを分離しないようにするため加工をしないようにする。このあとで、駆動ＩＣ４４（分離した電極のパタンのピッチに合わせて電極が配置されている）をチップフローなどによって取付る（図８）。基板４０の材質を適当に選択することによって、駆動ＩＣ４４の放熱を十分に行うことも可能となる。

【００１０】しかし、上記本出願人が先に提案したインクジェットヘッドによると、駆動ＩＣと圧電素子とを同一基板上に搭載する場合に有効であり、もし、外部に駆動ＩＣが有るときは、この駆動ＩＣに結線が必要になり、前記従来技術で述べたように、ワイヤボンディング等が必要となる。

【００１１】図１０は、更に他の従来技術の例を説明するための断面図で、図中、１は圧電素子、２は外部電極、３は導体パタン、３ａは上部支持部材、３ｂは下部支持部材、４は半田で、この半田４は、導体パタン３の一方の面に予め一様に施こされており、この導体パタン上の半田を各圧電素子のホット電極に重ね合せ、圧接、加熱して一括接合するものである。なお、図１０（ｂ）に接合後における図１０（ａ）のＢ－Ｂ線断面図、図１０（ｃ）に接合後の図１０（ａ）の平面図を示す。

【００１２】

【発明が解決しようとする課題】図１０に記載の従来技術は、導体パタン３または外部電極２に施こされている半田メッキが、均一に適量の場合は、隣接接合間（電極間）で半田のはみ出しによってショートすることは無いが、メッキの量が多すぎたり、不均一であったりする場合は、導体パタン３を外部電極２に接合したとき、幅方向に半田がはみ出してしまい、隣接接合間（電極間）でショートする恐れがある。本発明は、上述の如き実情に鑑みてなされたもので、特に、高密度に集積化された電気的アクチュエータ手段から外部への電気的接続において、加工性，組立性を向上させ、コストの低減を図ると共に、信頼性の向上に寄与するインクジェットヘッドを提供することを目的とする。

【００１３】

【課題を解決するための手段】本発明は、上記課題を解決するために、（１）基板と、インク液を収容する複数のインク流路と、各インク流路に連通されたノズルと、前記インク流路の各々に対応して設けられ、前記ノズルよりインク液を吐出させる複数の積層圧電素子より成るアクチュエータとを有するインクジェットヘッドであって、前記積層圧電素子に電極部材が配置された前記アクチュエータ、または、前記アクチュエータと電気的に接続され、電極部材が配置された前記基板に、保持部材によって保持されている導体パタンが、半田により電気的に接合しているインクジェットヘッドにおいて、前記圧電素子または基板の電極部材と前記保持部材の導体パタンとの接合領域を、隣接接合領域間で互いに異なるようにしたこと、更には、（２）前記接合領域の導体パタンの幅を、他の部分の導体パタンの幅よりも広くしたこと、更には、（３）基板と、インク液を収容する複数のインク流路と、各インク流路に連通されたノズルと、前記インク流路の各々に対応して設けられ、前記ノズルよりインク液を吐出させる複数の積層圧電素子より成るアクチュエータとを有するインクジェットヘッドの製造方法において、電極部材が設けられた分割されていない積層圧電素子から成るアクチュエータ、または、前記アクチュエータと電気的に接続され、電極部材が配置された基板と、保持部材によって保持されている導体パタンとを半田により電気的に接合し、次いで、接合部を独立した電気的接続にするための溝加工を行うこと、更には、（４）前記導体パタンは、圧電素子または基板の電極部材と重なる位置は分離せず、電極部材と重ならない位置は溝加工のピッチと同一のピッチに独立して形成してあることを特徴としたものである。

【００１４】

【作用】所定ピッチに配列された圧電素子の電極部材と、該ピッチに対応している導体パタンとを半田で接合する際に、半田接合面を隣接パタン間で異ならせることにより、パタン間の半田はみ出しによるショートを無くす。

【００１５】

【実施例】図１は、本発明の一実施例を説明するための図で、図１（ａ）は、図１０（ｃ）に相当する平面図、図１（ｂ）は、図１（ａ）のＢ－Ｂ断面図で、図中、１は圧電素子の各駆動部、２は外部電極（電極部材）、３は導体パタン、３ａは上カバー（保持部材）、３ｂは下カバー（保持部材）、４は半田で、圧電素子の各駆動部が多数一体的に形成されてアクチュエータを構成している。この実施例は、図１０に示した従来技術の改良型であり、図１０に示したようにして接合した時に、半田４がはみ出し隣接する電極からはみ出した半田と接触しないように、隣接する半田接合面（隣接接合領域）を、互いにずらしたものである。このように半田接合面をずら

すことにより、接合後の半田のはみ出しがあったとしても、隣接パタン間での半田のはみ出しによるショートがなくなり、インクジェットヘッドの信頼性が上がる。

【００１６】図２は、他の実施例を説明するための図で、図２（ａ）は、図１０（ｃ）に相当する平面図、図２（ｂ）は、図２（ａ）のＢ－Ｂ断面図で、この実施例は、図１で示した実施例の導体パタン３の接合部の幅を、図２（ａ）に破線４ａにて示すように、広くとったものである。この実施例の場合、図１で示した実施例より接合面積が広いため、接合強度がよくなる。

【００１７】図３は、本発明の更に他の実施例を説明するための図で、図３（ａ）は、図１０（ａ）に相当する断面図、図３（ｂ）は、図３（ａ）のＢ－Ｂ断面に相当する図で、図中、２′は内部電極、４′は内部電極２′と外部電極２とを接合している半田である。この実施例は、まだ分割されていない圧電素子１と導体パタン３とを半田接合をしてから、圧電素子１を導体パタン２ごと同時に溝加工（図３（ｂ）中のＳ部と図３（ａ）中のｄ部まで）するものである。この溝加工を行う際、上カバー３ａ，導体パタン３，下カバー３ｂとから成るＦＰＣ（フレキシブル・プリント・ケーブル）３′の導体パタン３がすでに所定のピッチに分割してあれば、そのピッチに合わせて溝加工をすることにより、それぞれ独立に分断された圧電素子１の電極２を取り出すことができる。また、図３（ｂ）に示すように、導体パタン３をベタパタン（圧電素子と接合される部分がパタン分断されておらず、一枚の板状になっている状態、図３（ｂ）中にクロスハッチにて示す）にしておけば、溝加工時に導体パタンを破損するような心配もなく、また、一枚面のベタパタンを接合し、その後に溝加工するようにしたので、接合面積を全て接合に利用できるので、接合部の強度を向上させることにもなる。

【００１８】なお、図１～図３に示した実施例では、半田メッキを使用しているが、本発明は、これに限ることはなく、異方性導電膜，導電性接着剤などを使用しても同様に適応させる。また、以上には、本発明を圧電素子とＦＰＣの接合に適用した場合の例について説明したが、本発明は、上記実施例に限定されるものでは、例えば、ＰＣＢ等の基板から電極を取り出す場合に同様に行うことができる。

【００１９】

【発明の効果】請求項１に対応する効果：半田メッキ領域が隣接パタン間で異なるので、接合時に半田がはみ出しても隣接間ショートが起きにくくなり、圧電素子の高密度化が可能で、しかも、インクジェットヘッドの信頼性を向上させることができる。

請求項２に対応する効果：半田メッキ領域のみ導体パタン幅が広いので、パタンピッチが狭くても強い接合強度が得られ、インクジェットヘッドの信頼性が上がる。

請求項３に対応する効果：圧電素子と導体パタンとの接合（加熱，加圧工程）後に溝加工して電極を独立分離するため、隣接パタン（電極）間は確実に分断されるので、隣接パタン間でシートが生じる心配もなく、また、パタン間のピッチを均一に溝加工できるので、インクジェットヘッドの加工性，組立性，信頼性が上がる。

請求項４に対応する効果：導体パタンの接合部に当る導体パタン部を一枚面（分断していない）のまま圧電素子に接合するので、接合強度がより強くなり、インクジェットヘッドの組立性，信頼性が上がる。

【図面の簡単な説明】

【図１】　本発明の一実施例を説明するための平面図及び断面図である。

【図２】　本発明の他の実施例を説明するための平面図及び断面図である。

【図３】　本発明の更に他の実施例を説明するための断面図及び平面図である。

【図４】　従来のインクジェットヘッドの断面図及び一部拡大断面図である。

【図５】　従来のインクジェットヘッドの圧電素子の結線を示す要部拡大図である。

【図６】　従来のインクジェットヘッドの他の例を説明する平面図である。

【図７】　従来のインクジェットヘッドの製造工程の一部を示す斜視図である。

【図８】　図７に示した工程の後工程の一部を示す斜視図である。

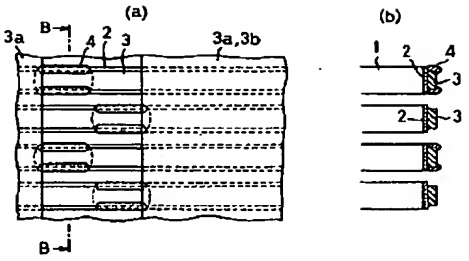
【図９】　図７，図８に示したインクジェット記録ヘッドの断面図（図８のＡ－Ａ線断面図）である。

【図１０】　従来のインクジェットヘッドの圧電素子の結線を示す他の例を示す図である。

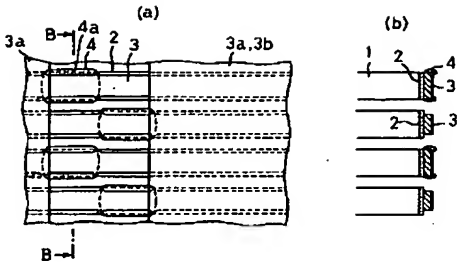
【符号の説明】

１…基板、２…外部電極、３…導体パタン、３ａ，３ｂ…保持部材、４…半田、１１…基板、１２…圧電素子、１３…流路板、１３ａ…インク流路、１３ｂ…壁部、１４…共通液室構成部材、１４ａ…共通液室、１５…インク供給パイプ、１６…ノズルプレート、１６ａ…ノズル、１７…ＦＰＣ、１８…リード線、１９…駆動電極部、１９ａ…駆動電極、１９ｂ…両端部電極、１９ｃ…共通電極、２０…溝、２１…保護板、２２…流体抵抗、２３…ホット電極、２４…グランド電極、２５…上部隔壁、３０…上部電極、３１…圧電素子、３２…ハンダ付け、３３…ドット電極、３４…共通電極、３５…本体、３６…下部電極、４０…基板、４１ａ～４１ｃ…電極、４２…圧電素子、４３…スリット、４４…駆動ＩＣ。

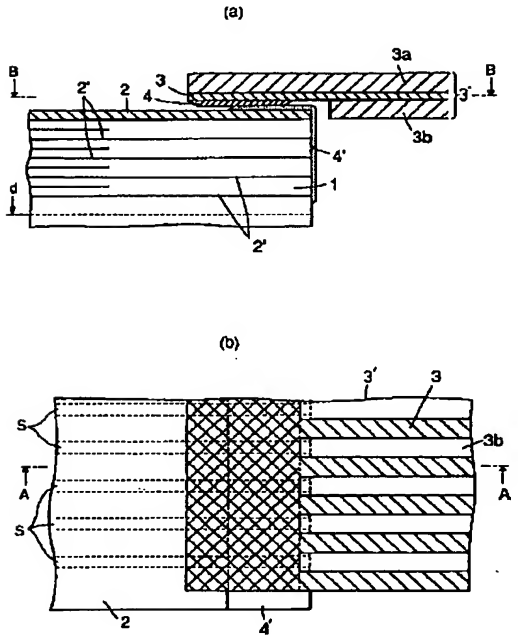
【図１】



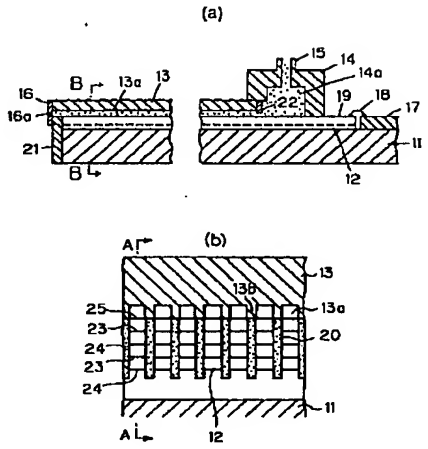

【図２】



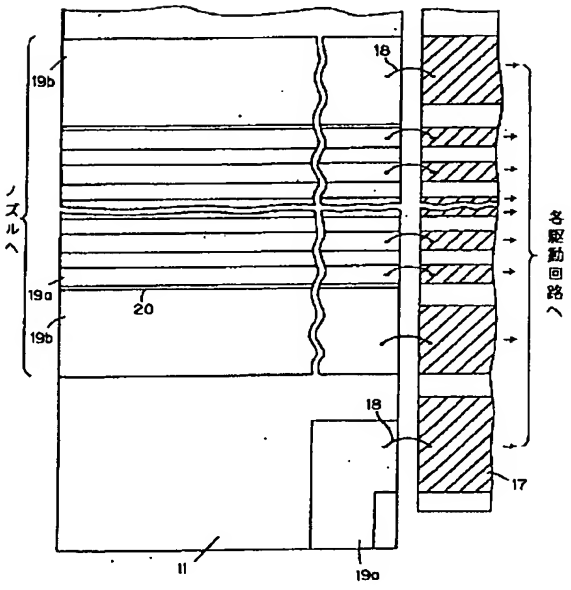

【図３】



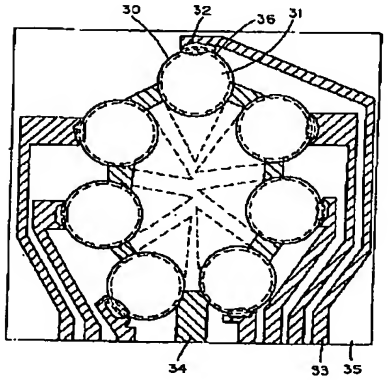

【図４】




【図５】




【図６】



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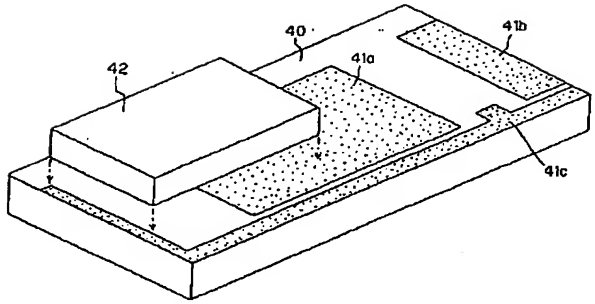
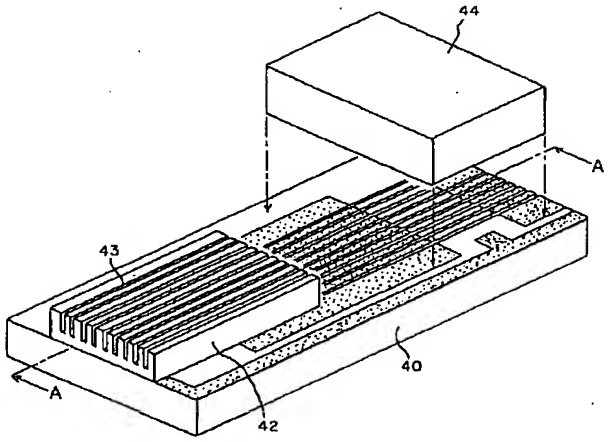
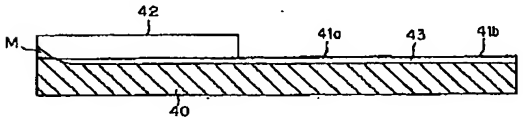


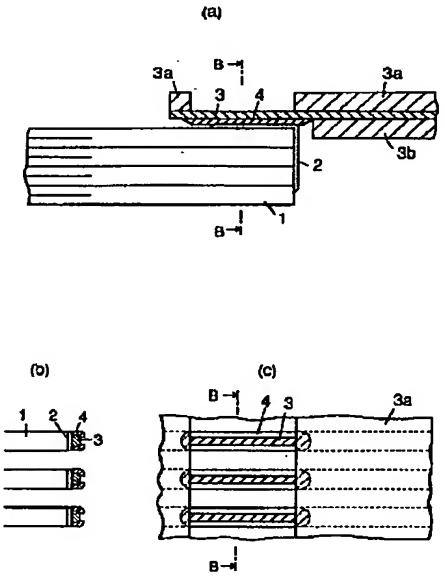

【図８】




【図９】




【図１０】

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| | | | Ｂ４１Ｊ　3/04 | １０３　Ｈ |